



**STRATEGY
RESEARCH
PROJECT**

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RESEARCH PARKS: AN AMERICAN SUCCESS

BY

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USAWC STRATEGY RESEARCH PROJECT

RESEARCH PARKS: AN AMERICAN SUCCESS

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ABSTRACT

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TITLE: Research Parks: An American Success

FORMAT: Strategy Research Project

DATE: 8 March 1996 PAGES: 28 CLASSIFICATION: Unclassified

As the 21st century approaches, Americans face the prospect of losing their competitive edge in a rapidly altering world economy unless they change their methods of industrial recruitment. This paper examines one proven stratagem for attracting, retaining, and nurturing high technology businesses: the research park. Cummings Research Park in Huntsville, Alabama, is offered as a case study. The paper concludes with an identification of those elements that have proven essential to the establishment of a research park.

INTRODUCTION

A major U.S. security concern has been whether the U.S. will remain competitive in the coming globalization of the world's economy. One of the least recognized developments in the emergence of a global economy is that there is an increasingly better balance of skills in the world; and for the most part, these skills tend to be technology based.¹ The long held belief that the only competitive edge of developing countries is cheap, unskilled labor has become a myth.

In virtually every part of this country, there is a growing sense of urgency about how to improve competitiveness. Mayors, city councilmen, county commissioners, and state governors are all focused on the need to stay viable in a radically evolving economy, and the focal point of this concern is high-technology businesses.

"Technology has been undergoing a process of globalization. International comparisons of patenting, Research and Development expenditures, and density of scientific and engineering personnel show a dispersion of technical competence and technological resources. The growth of trade in technology-based products has been faster than the growth of trade of resources based on labor-intensive products."²

So how can the U.S. maintain its competitive advantage in the category of high-technology industries? Is there an American model for creating, developing, and retaining high-technology companies and industries? The answer is a clear and resounding

affirmative. Over the last three decades, high-technology research parks have demonstrated an impressive level of success in attracting and nurturing those high-technology businesses that will be on the leading edge of tomorrow's economic development. This paper will examine the history of the research park and analyze the specifics of one existing park to identify those features that must be replicated by communities if they are to be active participants in the new global economy.

High Technology/Research Park Defined

It is difficult to define precisely a High Technology/Research Park. However, for the purpose of this paper the following definition used by the Urban Land Institute is offered:

"A high-quality development suited for a range of activities. When carefully designed and implemented, it is appropriate for Research and Development activities, high-technology and light-manufacturing activities, office and administrative functions, and a large offering of services. Scientists, engineers and technicians may work these days with white-collar professionals, clerical workers, and highly skilled production personnel."³

Research parks are attracting substantial interest from local and state governments concerned with economic growth and from universities attempting to support and expand their research activities. These organizations and institutions see research parks as natural havens--havens that promise a high-quality work

environment for high-technology industries.⁴

Undoubtedly, the emergence of research parks is linked directly to the growing high-technology sector in the industrial base of the U.S. The American economy has been undergoing a major transformation toward an economic structure primarily reliant on service employment, international trade, and the use of advanced technology.⁵ High-technology activities are expected to continue to be major growth sectors throughout the American economy. A majority of the new jobs created across all sectors of the economy involve high-technology activities.⁶

The Research Park and Universities

According to a study by Luger and Goldstein (1991), there were 116 research parks in the U.S., of which 84 or 72% opened after 1981.⁷ Virtually all of the research parks have formal or informal affiliations with nearby universities, and about 25% of research parks are directly owned by universities. Another 21% are university-private joint ventures, which means that universities have an ownership interest in 46% of the parks and at least a working relationship with the other research parks. Public money is involved in the ownership of over 50% of the research parks through public universities and other state and local government entities.⁸

Universities have several motives for being involved with research parks ranging from applied research opportunities and product development to employment opportunities for graduate students and faculty, entrepreneurship opportunities for faculty and graduates, a source of funding for the university, and institutional prestige.

According to Luger and Goldstein, research parks range in size from fewer than 50 acres to more than 5,000 acres with the average park size being about 600 acres.⁹ Employment within the park ranges from fewer than 25 to more than 25,000 persons.

As of February 1995, university-related research parks numbered 130--counting all stages of development. Together, these parks are home to 4,600 small, medium, and large technology-based companies and to some 250,000 employees. Because many are in early stages of development, their total combined capacity ultimately will exceed these numbers by many orders of magnitude.¹⁰

Two Research Parks of National Excellence

What is usually recognized as the first research park in the U.S. was developed in Palo Alto, California, in 1951 by Stanford University. As a result of its proximity to the San Francisco

Bay area, Stanford Research Park became the nucleus of what today is referred to as the Silicon Valley.

"Several of the early tenants that are still in the park--most notably, Hewlett-Packard, Watkins-Johnson, and Varian Associates--are now multinational corporations."¹¹

Today, 59 businesses in the Stanford Research Park employ approximately 28,000 high-technology workers.¹²

The Research Triangle Park in North Carolina occupies 6,800 acres in the middle of a triangle formed by the University of North Carolina in Chapel Hill, Duke University in Durham, and North Carolina State University in Raleigh.¹³ January 9, 1996, marked its 37th anniversary.¹⁴

Envisioned as a strategy to stem the brain drain of the brightest graduates leaving North Carolina, the Research Triangle Park today has 65 research companies and 55 service companies employing 34,000 people.¹⁵ The park lists an array of Fortune 500 companies--Data General, Dupont, IBM, Northrop--as well as international companies such as BASF, Burroughs-Welcome, CIBA-Geigy, GLAXO, Northern Telecom, Rhone-Poulenc, and Sumitomo.¹⁶

These two parks are widely known. However, there is another park less known but which has been just as successful. Cummings Research Park in Huntsville, Alabama, will be considered as a case study.

From Cotton to High-Technology

Cummings Research Park is the second oldest research park in the Southeast and also the second largest in number of persons employed, being topped in both instances only by Research Triangle Park in North Carolina.

A brief review of how Cummings Research Park began will illustrate how an industry-university-government partnership has contributed to its success and why Cummings Research Park has experienced an unusual conceptual and developmental history, but one that could be replicated in other localities with modifications. Its history provides valuable insights into those factors that determine the success or failure of such a venture.

In the Beginning

In 1950 Huntsville was a small, Southern county seat whose fortunes had been intimately bound to the cotton economy for a century and a half, first as a cotton producer and later as a textile city. Only with the advent of the Second World War and the establishment of two arsenals on the edge of Huntsville did the city shift its attention from cotton to federal programs. With the assignment of the team of German rocket scientists to

the reactivated Huntsville arsenals following the war, the city began a dramatic transformation as the unsuspecting town was inundated with military and space exploration programs supported by an international cast of employees.

The impetus for Huntsville's park arose during the late 1950s with the creation of NASA in 1958 and the establishment of the George C. Marshall Space Flight Center in Huntsville in 1960. Both the Marshall Space Flight Center and the Army Missile Command were headquartered at the Redstone Arsenal southwest of the city, and both were in a position to let extensive government contracts to private industry. In 1961 two events led to the establishment of the research park district. First, Brown Engineering, a large aerospace contractor, purchased 150 acres of land on the west side of the city to construct a new facility, and they subsequently sold parts of this parcel at cost to other companies working on government contracts in order to foster the creation of a concentrated high technology area. Second, in the same year, Dr. Werner von Braun, the director of Marshall Space Flight Center, recognized the need for an independent research facility to complement the work being conducted by NASA. Von Braun took his idea for such a facility to the Alabama Legislature which authorized a \$3 million bond issue-- subsequently approved by voters--to construct the University of

Alabama in Huntsville Research Institute.¹⁷

By 1963 the city government had designated almost 4000 acres around this nucleus for research park use, including the University of Alabama in Huntsville campus, and had adopted zoning regulations to assure that development would proceed in an orderly and attractive fashion. The following year the Research Park Advisory board was established by representatives of park tenants to oversee future development and planning. Because this was an early research park with few prototypes to serve as guides and because everything in Huntsville during the 1960s was fast-tracked by the demands of the space program, this original portion of the park was filled and the infrastructure built on a piecemeal basis.¹⁸ Nevertheless, by 1972 the park had attracted twenty-four tenants who had erected buildings totaling two million square feet of floor space and were employing some 7,200 persons.¹⁹

Cummings Research Park had come into existence because of the interaction of industry, which purchased the first tract of land; state government, which provided funding for a research institute; city government, which took responsibility for providing zoning regulations and the required infrastructure; and the university, which physically became part of Research Park and provided a home and staffing for the research institute.

A University Connection

In actuality, the university's association with Huntsville's high-technology development goes even deeper. UAH came into being in 1950 to serve the specific needs of Huntsville's scientific and technological community. The first master's degrees were awarded in the early 1960s, and the first undergraduate degrees followed in the late 1960s. This intimate involvement between the university and Huntsville's high technology enterprises is further apparent from the high level of local financial support tendered the school by the people of the city; and in turn, by the university's structuring of both its course offerings and its scheduling to permit adults to pursue degree programs or take additional course work while holding full-time jobs.²⁰

From Crisis to a Strategic Plan

During the 1970s space exploration ceased to be a top priority program of the federal government; and as the local boom faded, Huntsville suffered severe cutbacks. Several high-technology companies closed their Huntsville operations, and many highly paid, well-educated white collar persons left the city.

At the end of the decade, the community began to recognize that to maintain the city's exceptional quality of life, a major effort would have to be made to encourage new high-technology corporations to relocate there.²¹ A request to the Planning Commission in 1981 to rezone 1,000 acres of research park land for residential and commercial uses prompted a reassessment of the city's goals for future development.²²

Consequently, in 1982 the City of Huntsville appointed a Research Park Board composed of government and university officials and representatives of Cummings Research Park. The board was charged with planning for the expansion of the park and the recruitment of new businesses. The city, upon recommendation of the Research Park Board, hired two consultant firms to study Huntsville's situation and make recommendations for a future course of action. Furthermore, the city initiated a policy of purchasing vacant land within the research park district for improvement and resale to prospective tenants. The board members visited other successful research parks to assess the competition and to begin recruitment of new firms.²³

The first consultant report was a land use master plan for Cummings Research Park West completed by MCI/Consulting Engineers of Nashville and Huntsville. Unlike the original portion of Research Park which developed without a master plan, Research

Park West was totally planned before any land was sold. Drainage, lot layout, utilities, roads, and landscaping were all designed according to the master plan to create an attractive environment featuring those amenities demanded by high-technology companies.²⁴

The second report, prepared by Battelle Laboratories of Columbus, Ohio, addressed the question of which companies would be most desirable and realistic for Huntsville to acquire and outlined a marketing strategy for recruiting them.²⁵

The university was an active participant in this planning process. University representatives served on the Research Park Board; but more importantly, the university worked to strengthen those academic programs in engineering, mathematics, and the sciences that are crucial to research park companies. Additional state funding was sought to permit the hiring of new faculty and the upgrading of facilities and equipment to make the school even more responsive to the needs of increasing numbers of already well-educated students. One result of UAH's efforts to expand its scientific capabilities has been the designation of the UAH Center for Applied Optics as a center of excellence for high speed optical computing.²⁶

Although the first half of the park must be considered successful by any standards, the city felt that the western half

could be even better. The expectations of prospective tenants had escalated since the park was first opened, and the city had recognized the advantages that accrue from offering first quality developments with high levels of amenities. Consequently, the Huntsville planning department established new zoning regulations for Research Park West that specify a larger minimum lot size as well as more stringent landscaping standards designed to beautify the site, screen parked cars, and soften the parking lots. The new zoning regulations further define maximum building height as a function of yard depth and establish consistent signage requirements throughout the park to include entrance pylons, traffic control signs, tenant ground signs, and building-mounted signs.²⁷

Covenants and Design Control

The city also adopted a set of protective covenants to run with the Research Park lots when sold that will ensure a higher quality development than can be attained through zoning regulations alone and that will assure that these standards are maintained in the future. An owners' and occupants' association was established to hold title to common areas and common facilities, to provide for their maintenance, improvement and

beautification, and to assess the membership for operating funds.²⁸

A design control committee was also activated by the covenants and charged with approving plans for all proposed construction in the park prior to issuance of a building permit. The six members of this committee must include an architect, a landscape architect, and a professional engineer. It is the committee's responsibility to see that all buildings, landscaping, and other improvements conform to the covenants and harmonize with each other regarding design, quality, materials, color, setting, height, and elevations. Further restrictions placed on development in Research Park West include replacement of all trees removed during construction, the concealment of mechanical equipment, loading docks and refuse containers, a ban on exposed metal or utility block and wood-frame buildings, and implementation of an approved lighting plan.²⁹

These actions were outlined in the MCI/Consulting Engineers' master plan. However, once the infrastructure was built, the recruitment of high-technology industries had to begin. This was the point at which the Battelle Report became important.

The Battelle Report identified specific types of high-technology and growth activities that were appropriate for the Huntsville area. This target industry identification list was

based upon an examination of operational characteristics, market linkages, supply relationships, growth factors, and the unique set of demands and economic linkages that were associated with the Huntsville area by virtue of the powerful concentration of governmental, scientific, and technological entities already in place.³⁰

The report also recommended a specific marketing strategy to attract and recruit the identified high-technology industries. Some of the more important recommendations for city action were to target specific industries and firms; create an identification and monitoring system; prepare development materials such as profiles and fact books; strengthen the city's industrial advertising and public relations efforts; expand direct mail and prospecting activities; and hire a full-time manager for Cummings Research Park.³¹

According to Bill Dean, current manager of Cummings Research Park, these recommendations were implemented with notable success.

Supercomputers and ISDN

One final example of strategic vision is that of computing and digital networking.

In the late 1980s, the State of Alabama proposed to fund the purchase of a supercomputer and make it available to private firms, state universities, and government agencies to enhance research capabilities. The City of Huntsville donated a seven-acre site in Cummings Research Park to house the multi-million dollar Cray computer. The state located the supercomputer in Cummings and connected it with node sites in seven Alabama cities. It was and continues to be a great asset to all users.³²

Additionally, in the early 1990s, South Central Bell invested millions of dollars installing state-of-the-art telecommunications facilities in Cummings Research Park. This investment in telecommunication infrastructure provided tenants within the park access to the fully Integrated Services Digital Network (ISDN). Tenants now have access to state-of-the-art digital communications providing specialized high-speed and high-volume service.³³

Cummings Research Park Today

What is the current situation in Cummings Research Park? Has the momentum from crisis to a strategic plan created high-technology jobs and the relocation of high-technology industries? According to the park manager, there are currently 160 high-

technology, research, service, and manufacturing companies employing more than 20,000 people in the park. It has attracted companies which constructed buildings containing more than seven million square feet of floor area. Cummings Research Park occupies 3,800 acres and is home to many of the country's best known companies, including Lockheed Missiles and Space Company, Teledyne Brown Engineering, United Technologies, Chrysler Corporation, TRW, Computer Sciences Corporation, Nichols Research Corporation, Johnson Controls, Martin Technologies, Motorola UDS, BDM, IBM, Rockwell International, McDonnell Douglas, and Hughes Missiles and Space Systems.³⁴

Huntsville, Alabama, has made tremendous progress and gone through great change since 1950. Instead of depending upon cotton for its economic future, it is depending upon high-technology industry. What a great success story. A success much dependent upon Cummings Research Park.

Criteria for Success

Based on the Huntsville experience and a review of the literature, there are certain constants which are necessary for the success of any research park. The geographic and environmental factors that business leaders look for include:

high-quality residential areas within a reasonable commuting distance; abundant housing choices by type and reasonable cost; very good elementary and secondary schools (both public and parochial); flexibility to expand at reasonable cost; pleasing surrounding aesthetics and no negative mixed land uses in or contiguous to the park; one or more major universities in close proximity, preferably with strong graduate programs in math, the sciences, engineering, computer sciences, the biological sciences, and business and management; shared university facilities, especially library and computer resources; cooperative university programs available for employees as well as high technology activity; possibility of recruiting university graduates; an area characterized by a significant pool of technicians and other support staff and by several technical schools; proximity to high-quality air transportation; a wide range of cultural and recreational activities in the community to meet the requirements of quality life; an area characterized by an existing or expanding pool of high technology industries and services; and a positive overall business climate in terms of incentives and labor-management relations.³⁵

University support provides a great number of resources that can contribute to the success of the research park and its individual tenants and without which the park may fail or lower

its standards and lose its focus. These resources include the capabilities and expertise of the faculty; extensive library resources; the availability of professional seminars, symposia, and conferences, which serve to keep technical and scientific staff up to date; the availability of graduate students to serve as employees for selected research and projects; professional growth opportunities in both continuing education and advanced degrees for park employees; personnel screening and support; shared facilities and equipment, such as computers and laboratories; and contract research support provided by the university.³⁶

The most successful research parks possess another common characteristic which is the strict application of a clear and concise set of covenants. Virtually every successful research park has a formally adopted and clearly documented set of covenants that govern activities within the park. Typically, the contents of these documents include a description of the park, definitions of terms used, general provisions, variance procedures, permitted land uses, performance standards, space allocations, parking and loading requirements, architectural and engineering guidelines, and review procedures. The covenants apply not only to new tenants but also to existing occupants undertaking an expansion, new landscaping, or new signage.³⁷

Another reason that a research park is successful is that all aspects of park design including overall plan, buildings, and landscaping are required to be of high quality. This does not occur by accident and in most cases reflects a strict combination of design covenants and zoning regulations. For example, structures must be finished on all sides; metal clad buildings, metal roofs, and wood frames are not permitted; and the most desirable materials include masonry, brick, stucco, and selected forms of aggregate.³⁸

An examination of employment patterns within research parks reveals several important findings. First, activities related to research, development, and certain types of administration related to research management are important and may account for between 25 and 35% of all jobs.³⁹ However, the largest number of employees in these developments are frequently associated with light manufacturing and high-technology production, which accounts for 30 to 50% of all jobs.⁴⁰ The remaining employment categories tend to be quite diverse, with office and administrative activities being most important but also encompassing personal and business services.

By way of example, Cummings Research Park allows laboratories, offices, prototypical and research-related productions, as well as shops, banks, post offices, and other establishments.⁴¹ Several of

the park occupants provide a wide range of services for employees including access to physical fitness centers, day care, and jogging paths.

The activities that are missing tend to include distribution warehousing, heavy manufacturing, and industries related to the processing of raw materials.

Finally, it is important to understand that a successful research park takes time to establish. The land has to be acquired, improved, appropriately zoned, placed under covenants, and management installed so that marketing can begin. The marketing must be targeted, professional, and aggressive. As the park grows, it begins to create its own successes from its ability to offer financial incentives, incubator spaces for fledgling businesses, and the support of a critical mass of high-technology businesses working together. A healthy research park becomes a magnet for similar companies which prefer to locate where interaction among companies and employees creates a heightened sense of mission and leads ultimately to enhanced levels of excellence.

CONCLUSIONS

In order to stay competitive with other nations, America's leaders at all levels must recognize that we are in the midst of a major transformation from an industrial-service dominated economy to an information economy; and these new businesses, which derive their profits from continually evolving new technologies, have different needs than did the older materials-processing industries. It simply is no longer sufficient to identify a bare tract of ground as an industrial site and expect a corporation to respond.

In order to capture these new high-technology businesses, a community must learn which enticements are attractive to their CEOs and their boards and then make them available. One already proven marketing technique is the strictly controlled research park. Obviously, not every community has the basic resources to compete on this level, but those that do should evaluate their future with respect to the life style and employment opportunities they want for their citizens and then determine how their community can best participate in the new technology-based age.

Previous experience has demonstrated that certain prerequisites are essential to the creation of a successful

research park, the most critical being a working relationship with a university to promote shared research and ongoing employee education; good air and highway transportation; strong quality of life of the community including an excellent educational system; outstanding park design and amenities regulated by comprehensive covenants; restrictions on permitted uses in the park; and a strong program for park promotion and management.

The research park will not be the only tool for attracting and holding new high-technology industries, but the pioneering parks have already illustrated the effectiveness of the concept and provided the guidelines for replication. Obviously, as technology advances, requirements of companies will also modify. But if a community stays responsive to these changes, it should be in a position to accommodate and incorporate the shifting needs of industry.

The U.S. cannot afford to rest on its past successes or it will find itself still mired in a defunct 20th century economy while more progressive countries are exploring the frontiers of the 21st century. The new high-technology economy is global and it is here. If we as a country do not respond to these changes, then high-technology companies will go elsewhere--and that could very well be abroad.

ENDNOTES

1. Pete Engardio, "A Hothouse of High-Tech Talent," Business Week, 23 November 1994, 126.
2. Institute for National Strategic Studies, Strategic Assessment 1995 U.S. Security Challenges in Transition (Washington, D.C.: GPO, 1995), 195-96.
3. Douglas R. Porter, Research Parks An Emerging Phenomenon," Urban Land Institute, June 1984, 7.
4. Harvey A. Goldstein and Michael I. Luger, Technology in the Garden (Chapel Hill, N.C.: University of North Carolina Press, 1991), xv.
5. Kevin Kelly and Richard A. Melcher, "America's Heartland The Midwest's New Role in the Global Economy," Business Week, 5 July 1994, 116.
6. Ibid., 118.
7. Goldstein and Luger, 2.
8. Ibid., 52-53.
9. Ibid., 50-51.
10. Bob Olson, Testimony on the Future of the U.S. Economic Development Administration, Posture Statement presented to the House Subcommittee on Public Buildings and Economic Development. (Washington: Association of University Related Research Parks, 23 Feb 1995), 1.
11. Goldstein and Luger, 122.
12. Ibid.
13. Ibid, 76.
14. Jeanne P. Brewer, "Research Triangle Park," Nature, 10 March 1994, 169.
15. Ibid.
16. Goldstein and Luger, 76.

17. Linda Allen, Report of the Cummings Research Park (Huntsville, Al.: City Planning Department, 1994), 2.
18. Ibid., 3.
19. Bill Dean, manager Cummings Research Park, interview by author, 22 December 1995, Huntsville, Al.
20. Allen, 4.
21. Ibid, 6.
22. Minutes of the Huntsville Planning Commission, April, May 1981.
23. Minutes of the Huntsville Research Park Board, March 1982 - November 1983.
24. Ibid.
25. Ibid.
26. Allen, 8.
27. Minutes of the Huntsville Planning Commission, June 1994.
28. Ibid.
29. Ibid.
30. Dr. Charles W. Minshall, "The Clarification of Planning Guidelines and the Identification of Principle Activities" (Columbus, Ohio: Battelle Labs, 1983(), III-64.
31. Ibid, III-32.
32. Dean interview.
33. Ibid.
34. Ibid.
35. See Goldstein and Luger, 490-70; Dr. Mark L. Money, "Profiting from University/Industry Relationships," Virginia Tech, 30 September 1991; David R. Lampe and Susan Rosegrant, Route 128 (New York: Basic Books, 1992), 182-201; and Dr. Charles Minshall, "The Clarification of Planning Guidelines and the Identification of Principle Activities." Columbus, Ohio: Batelle Labs, 1983.

36. Minshall, "The Clarification of Planning Guidelines and the Identification of Principle Activities," 34.

37. Ibid, 35.

38. Ibid, 36.

39. Dr. Mark L. Money, consultant, interview by author, 8 June 1995, Phoenix, AZ.

40. Ibid.

41. Huntsville Zoning Ordinance as amended 1995.

BIBLIOGRAPHY

- Allen, Linda. Report of the Cummings Research Park. Huntsville, Al.: City Planning Department, 1994.
- Anthes, Gary H. "Strong growth predicted for high-tech industry." Computerworld, 18 January 1993, 93.
- Bottoms, David T. "High-tech drives new U.S. export strategy." Electronics, 11 October 1993, 9.
- Brewer, Jeanne P. "Research Triangle Park." Nature, 10 March 1994, 169.
- Burton, Daniel F. Jr., Victor Gotbaum, and Felix G. Rohatyn, eds. Vision for the 1990s. Cambridge, Mass.: Ballinger, 1989.
- Dean, Bill, manager Cummings Research Park. Interview by author, 22 December 1995, Huntsville, Al.
- Engardio, Pete. "A Hothouse of High-Tech Talent." Business Week, 23 November 1994, 126.
- Fischer, David, and John Simmons. "High-tech Karma." U.S. News and World Report, 21 August 1995, 45.
- Gershon, Diane. "San Antonio Aims for Spot on High-Technology Map." Nature, 25 June 1992, 638.
- Goldstein, Harvey A., and Michael I. Luger. "Research Parks: Do They Stimulate Regional Economic Development?" Commentary, Spring 1989, 3.
- Goldstein, Harvey A., and Michael I. Luger. Technology in the Garden. Chapel Hill, N.C.: University of North Carolina Press, 1991.
- Headden, Susan. "The Silicon Dominion." U.S. News and World Report, 30 October 1995, 51.
- Huntsville Zoning Ordinance. Amended 1995. Huntsville, Al.: City Council, 1995.
- Institute for National Strategic Studies. Strategic Assessment 1995 U.S. Security Challenges in Transition. Washington, D.C.: GPO, 1995.
- Kelly, Kevin, and Richard A. Melcher. "America's Heartland The

- Midwest's New Role in the Global Economy." Business Week, 5 July 1994, 116.
- Kysiak, Ronald C. "The Impact of Research Parks on Regional Development." The Real Estate Finance Journal, Fall 1989, 64.
- Lampe, David R., and Susen Rosegrant. Route 128. New York: Basic Books, 1992.
- Larkin, G. Richard. "Public-Private Partnerships in Economic Development: A Review of Theory and Practice." Economic Development Review, Winter 1994, 7.
- Minshall, Charles, Dr. "An Overview of Science Parks and Settings for High Technology Activities." Economic Development Review, Winter 1984, 17-26.
- Minshall, Charles W., Dr. "The Clarification of Planning Guidelines and the Identification of Principle Activities." Columbus, Ohio: Battelle Labs, 1983.
- Minutes of the Huntsville Planning Commission. 1981 and 1984.
- Minutes of the Huntsville Research Park Board. March 1982 - November 1983.
- Money, Mark L., Dr., consultant. Interview by Author, 8 June 1995, Phoenix, AZ.
- _____. "Profiting from University/Industry Relationships." Virginia Tech, 30 September 1991.
- Olson, Bob. Testimony on the Future of the U.S. Economic Development Administration. Posture Statement presented to the House Subcommittee on Public Buildings and Economic Development. Washington: Association of University Related Research Parks, 23 Feb 1995.
- Porter, Douglas R. "Research Parks An Emerging Phenomenon." Urban Land Institute, June 1984, 7.
- Thurow, Lester C. "The New Economics of High Technology." Harper's, March 1992, 15.